

Revision of the Gall Midges of Bald Cypress (Diptera: Cecidomyiidae)¹

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Four Nearctic species of gall midges have been described from *Taxodium distichum* (L.) Richards (Taxodiaceae). *Retinodiplosis taxodii* Felt, which aborts the seeds, is here transferred to *Sequoiomylia* Möhn, a genus known previously only from a larva and pupa found in seeds of fossil *Sequoia langsdorfi* (Brongn.) Heer from a probable Miocene stratum in Germany. Two species, *Cecidomyia taxodii* Felt and *Cecidomyia anthici* Felt, responsible for flowerlike leaf galls, are synonyms of *Cecidomyia cupressi* (Schweinitz), which was named on the basis of the gall only, then thought to be caused by a fungus. *C. cupressi* and *Thecodiplosis cupressiananassa* (Osten Sacken), which causes the cypress twig gall, are transferred to a new genus, *Taxodiomyia*. The three valid species are redescribed and the adult of *Sequoiomylia* is characterized for the first time.

Sequoiomylia, *Taxodiomyia*, and *Cecidomyia* are closely related and are placed in the tribe Cecidomyiini. Harris (1966) redefined the tribes of the supertribe Cecidomyiidi but left certain genera, *Cecidomyia* among them, unassigned formally to tribe. Since the family and supertribe are based on *Cecidomyia*, this genus should have been assigned to the tribe Cecidomyiini. Besides adult characters, the tribes of Cecidomyiidi are characterized by good distinguishing larval characters, especially in the form of the terminal papillae. The salient characters of the larvae of *Cecidomyia*, viz. the long lateral extensions of the head capsule, the diminutive terminal segment, and the elongated abdominal segment VIII with its heavily sclerotized and modified spiracles, are probably all modifications for living in resinous deposits on pine, the habitat of all known Nearctic species of *Cecidomyia*. If so, relatives of *Cecidomyia* that have exploited other niches are likely to differ substantially from it, as do *Sequoiomylia* and *Taxodiomyia*. The two last-named genera seem to be related to *Cecidomyia* on the basis of a broad spectrum of adult characters. Only three genera constitute the tribe Cecidomyiini which can be characterized as follows: postvertical peak absent; eyes broadly joined on the vertex; antennal flagellomeres I and II superficially connate; male flagellomeres binodose, usually trifilar, their circumfila short and usually many-looped, and the internodes and necks short; palpus 3 to 4 segmented; tarsal claws untoothed.

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variously curved, usually stout; male genitalia with a stout, unlobed basimere and a short, straight-sided, narrow to wide aedeagus; the ovipositor usually short and fleshy, but if long, the dorsal lamellae completely fused together; terminal papillae of larvae usually reduced to 2 or 3 pairs, none greatly enlarged or sclerotized.

The tribe Cecidomyiini differs from the Contariniini chiefly in the characters of the ovipositor and larval terminal papillae. The Cecidomyiini and the Contariniini are closer to each other than either is to any of the other tribes of the Cecidomyiidi and are both made up entirely of primary plant feeders.

In the descriptions of species that follow, the proportions of the parts of the male flagellomere III are approximate only. The proximal circumfilum on a flagellomere is called "circumfilum I," and so on. Length of the ovipositor is measured from the posterior edge of tergum VIII.

KEY TO NEARCTIC CECIDOMYIINI

1. Tarsal claws strongly curved beyond middle (Fig. 3); aedeagus wide, more than $\frac{1}{2}$ as wide as sternum X; ovipositor short with 2 large dorsal lamellae. **Cecidomyia** Meigen
- Tarsal claws not strongly curved (Fig. 2); aedeagus narrow, less than $\frac{1}{3}$ as wide as sternum X (Fig. 1); ovipositor short or long; if long, with completely fused dorsal lamellae (Fig. 5) 2
2. More than 80 dorsocentral and 20 anepimeral setae on thorax; ovipositor short, lamellae separate (Fig. 4) **Sequoiomyia** Möhn
- Less than 40 dorsocentral and 15 anepimeral setae on thorax; ovipositor long, lamellae fused together (Fig. 5) . . **Taxodiomyia**, n.g.

Sequoiomyia Möhn, 1960

Adult. Postvertical peak absent. Palpus 4-segmented, each segment longer than the preceding. Male flagellomeres superficially connate, trifilar, slightly constricted between circumfila II and III; internodes and necks not very short. Wing darkish, cell between C and R_1 darker than remainder of membrane; Cu_1 and Cu_2 present but weak; M_{3+4} and Rs not evident. Tarsal claws tapering gradually from base to apex, not strongly curved (Fig. 2); empodium well developed but not quite as long as claws. Sterna entire, setae sparse immediately proximad of the several apical rows; male tergum VII weak apically, apical row of setae absent, setae sparse elsewhere; male tergum VIII weakly sclerotized, without setae. Ovipositor short, soft; lamellae ovoid, bilaterally compressed. Male genitalia (Fig. 1): tergum X deeply bilobed, sternum X only slightly emarginate; aedeagus narrow, tapering slightly from base to apex, shorter than basimere; the latter stout, unlobed, with many setae; distimere tapering from base to apex, strongly curved, with many setae.

Larva. Lateral extensions of head capsule less than $\frac{1}{2}$ length of entire head. Spatula present, variously shaped. Dorsal papillae with or without hairs. Foreventral and pleural areas with very fine, pointed verrucae; remainder of integument smooth. Terminal segment smooth with 8 papillae, 4 haired.

Type-species, *Sequoiomyia kracuseli* Möhm (orig. des.).

The genus *Sequoiomyia* was named for *S. kracuseli* Möhm based on a larva and pupa taken from fossilized seeds of *Sequoia langsdorfi* (Brongn.) Heer from a probable Miocene stratum (Möhm, 1960). Though the larva differs in minor respects from that of *S. taxodii* (Felt), none of the differences preclude referring the latter species to *Sequoiomyia*. Both species occur in the same niche on their respective hosts, both of which belong to the Taxodiaceae.

Sequoiomyia taxodii (Felt)

taxodii Felt, 1916: 415 (*Retinodiplosis*); Felt, 1921: 158 (*Retinodiplosis*); Berry, 1924: 24 (as *Retinodiplosis* sp.); Berry, 1933: 24 (*Retinodiplosis*); Foote, 1965: 290 (as j, syn. of *cupressi* Schweinitz, in unplaced species of *Cecidomyiini*).

Adult. Male flagellomere III: length proximal node (in % total length), 24; internode, 13; distal node, 40; neck, 23; circumfilum I barely reaches distal node; circumfilum II does not reach circumfilum III, which does not reach flagellomere IV; area between bases of circumfila I and II and immediately distad of circumfilum II devoid of setulae; setulae absent beyond base of circumfilum III. Female flagellomere III: neck approximately $\frac{1}{3}$ length of node, devoid of setulae. Wing length, 3-3.6 mm. Chaetotaxy: pronotal setae 12-18; mesanepisternal, 23-25; mesanepimeral, 23-27; dorsocentral, 95-103. Proportions of foreleg (average of 2 specimens): femur, 1.00; tibia, 1.00; tarsomere I, 0.13; II, 0.81; III, 0.44; IV, 0.31; V, 0.20. Ovipositor: about .20 length of abdomen. Male genitalia as in Fig. 1.

Larva. Spatula wide, bidentate (Fig. 6). Dorsal papillae with short setae. Setae of 2 terminal papillae longer than those of dorsal papillae.

Material examined. Lectotype here designated, male, Charleston, Mo., V-2-1916, from cones of *Taxodium distichum*, a2722 in Felt Collection (on loan to the USNM from the New York State Museum in Albany). Paralectotypes: male, 2 females, 2 pupae, 3 larvae, same data as above.

I have not seen the paralectotype galls from Mud Lake, Ark. (XI-14-1910, W. L. McAtee).

The larva of this species differs from that of *S. kracuseli* by the haired dorsal papillae and the shape of the spatula. *S. taxodii* aborts the seeds of bald cypress. The galls are figured on page 46 in Felt, 1940. Berry (1924) found damage typical of this species on Pleistocene fossil *T. distichum* unearthed in Washington, D. C.

Taxodiomyia, NEW GENUS

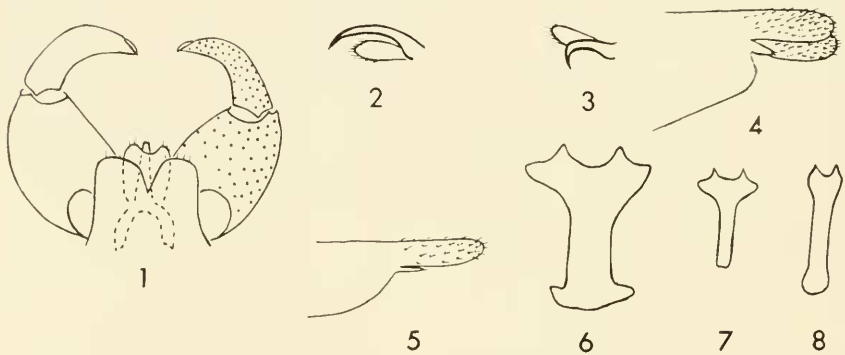
Adult. Postvertical peak absent. Palpus 4-segmented. Male flagellomeres superficially connate, bifilar or trifilar. Wing hyaline; Cu_1 and Cu_2 weak to evanescent; Rs and M_{3+4} not evident. Tarsal claws tapering gradually from base to apex, not strongly curved (as in Fig. 2); empodium well developed but not quite as long as claws. Sterna II-V entire, setae absent in a transverse band immediately proximad of apical setae

Male tergum VII quadrate and well sclerotized to weakly sclerotized apically; tergum VIII weakly sclerotized, devoid of setae. Ovipositor long, retractile, dorsal lamellae fused into a single lobe (Fig. 5). Male genitalia (as in Fig. 1, but with fewer setae): tergum X bilobed; sternum X slightly emarginate; aedeagus narrow, parallel-sided; basimere stout, unlobed; distimere tapering from base to apex.

Larva. Lateral extensions of head capsule less than $\frac{1}{2}$ length entire head. Spatula present, variously shaped. Dorsal papillae with short setae. Whole integument covered with small, pointed verrucae. Terminal segment with 2 pairs of haired papillae.

Type-species, *Cecidomyia cupressiananassa* Osten Sacken.

Taxodiomyia contains 2 species, both gall formers on *T. distichum*. One of the species has bifilar flagellomeres, the other trifilar. The 2 species are so close in all other respects that, in this case, I consider the difference in the number of circumfila superficial. The upper lamellae of the ovipositor are unique in the supertribe Cecidomyiidi in that they are completely fused to form a single dorsal lobe. All of the Contariniini have elongate ovipositors, but the upper lamellae, however modified, always retain their integrity.



FIGURES 1-8: FIG. 1. Male genitalia of *S. taxodii* (dorsal). FIG. 2. Tarsal claw of *S. taxodii*. FIG. 3. Tarsal claw of *Cecidomyia* sp. FIG. 4. Lamellae of ovipositor of *S. taxodii*. FIG. 5. Lamellae of ovipositor of *T. cupressi*. FIG. 6. Spatula of *S. taxodii*. FIG. 7. Spatula of *T. cupressi*. FIG. 8. Spatula of *T. cupressiananassa*.

Taxodiomyia cupressiananassa (Osten Sacken) NEW COMBINATION

cupressi ananassa Riley, 1870: 244 (polynomial name unavailable; *Cecidomyia*); *cupressiananassa* Osten Sacken, 1878: 3 (*Cecidomyia*); Riley and Howard, 1891: 125 (as *Cecidomyia ananassae* Riley); Felt, 1908: 392 (as *Contarinia ananassi* Riley); Felt, 1912: 242 (as *Thecodiplosis ananassi* Riley); Felt, 1918: 125 (as *Thecodiplosis ananassa* Riley); Foote, 1965: 278 (*Thecodiplosis*).

Adult. Male flagellomere III: bifilar; length proximal node (in % total length), 32; internode, 5; distal node, 37; neck, 25; circumfilum I reaching beyond short internode but not to base of circumfilum II; latter not reaching base of flagellomere IV;

internode and neck devoid of setulae; only one row of setae proximad of base of circumfilum I. Female flagellomere III: neck approximately $\frac{1}{3}$ length of node, devoid of setulae. Wing length, 1.7-1.8 mm. Chaetotaxy: pronotal setae, 2-3; mesanepisternal, 0; mesanepimeral, 6-9; dorsocentral, 20-20. Proportions of foreleg (average of 5 specimens): femur, 1.00; tibia, 0.98; tarsomere I, 0.13; II, 0.70; III, 0.32; IV, 0.20; V, 0.15. Male tergum VII with setae present only apicolaterally. Ovipositor: 0.44-0.48 length of abdomen. Male genitalia as in Fig. 1 but with fewer setae.

Larva. Spatula (Fig. 8) almost parallel-sided, bidentate anteriorly, the teeth acute.

Material examined. Lectotype here designated, male, Savannah, Tenn., emerged V-4 to 9-1870, J. P. S., deposited in U. S. National Museum; paralectotypes: 4 ♀♀, same data as lectotype; others probably lost include 2 ♂♂, 1 larva, 1 pupal exuvia, and galls, all with same data as lectotype; 2 ♂♂, 3 ♀♀ Carbondale, Ill., VI-20-1966, *ex* cypress galls, J. Appleby; 10 ♀♀, Baton Rouge, La., V-15-1935; 2 larvae, Lafayette, La., XI-1-1953, F. S. Goetch; 2 ♂♂, 4 ♀♀, loc. ?, *ex* cypress, 1883.

T. cupressiananassa causes large, spongy, brown swellings on the branchlets of bald cypress. The host was originally reported as *Cupressus thyoides* L. (now *Chamaecyparis thyoides* (L.) BSP.) (Riley, 1870a), but this was an error (Riley, 1870b).

Taxodiomyia cupressi (Schweinitz), NEW COMBINATION

cupressi Schweinitz, 1822: 92 (*Merulius*, a fungus); Foote, 1965: 290 (as unplaced species of Cecidomyiini).

taxodii Felt, 1911: 556 (*Itonida*); Felt, 1921: 205 (*Itonida*).

anthici Felt, 1913: 278 (*Itonida*); Felt, 1921: 203 (*Itonida*); Foote, 1965: 289 (as unplaced species of Cecidomyiini). N. syn.

Adult. Male flagellomere III: trifilar; length proximal node (in % total length), 26; internode, 14; distal node, 42; neck, 18; circumfilum I not reaching distal node; circumfilum II not reaching base of circumfilum III; last not reaching flagellomere IV; setulae absent from internode and neck, also sparse near bases of circumfila: 1-2 rows of setae proximad of base of circumfilum I. Female flagellomere III: neck approximately $\frac{1}{3}$ length of node, devoid of setulae. Wing length, 1.8-2.3 mm. Chaetotaxy: pronotal setae, 1-3; mesanepisternal, 0-2; mesanepimeral, 10-15; dorsocentral, 28-35. Proportions of foreleg (average of 5 specimens): femur, 1.00; tibia, 1.06; tarsomere I, 0.13; II, 0.73; III, 0.36; IV, 0.24; V, 0.18. Male tergum VII quadrate, with almost a full row of apical setae. Ovipositor: length about 0.40-0.43 of entire abdomen. Male genitalia as in Fig. 1 but with fewer setae.

Larva. Spatula (Fig. 7) with lateral extensions, bidentate, the teeth acute.

Material examined. Lectotype of *Itonida taxodii* here designated, female, Fla., III-26-1883, reared from leaves of bald cypress, H. G. Hubbard, c1038 in Felt Collection (on loan to USNM by N. Y. State Museum in Albany); paralectotype of *I. taxodii*, male, not seen; lectotype of *Itonida*

anthici, male, Barachias, Ala., W. L. McAtee, a2120, USNM Type No. 29272; paralectotypes of *I. anthici*, 3 ♂♂, 3 ♀♀, 2 larvae, 1 pupal exuvium, all with same data as lectotype and 1 larva with same data except locality, Mud Lake, Ark.

T. cupressi forms the flowerlike galls on the leaves of bald cypress, figured on page 46 in Felt, 1940. *C. tarodii* was originally described as reared from leaves of bald cypress. Felt (1921) later added that it was reared from "conical, globular or elongate deformations" of the leaves. The gall formed by *C. anthici* may be described as conical or elongate deformations. At any rate, the synonymy of *C. tarodii* and *C. anthici* is apparent on the basis of morphological similarity of the adults.

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